

Fan Septoplasty for Correction of the Internally and Externally Deviated Nose

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With recent exception, the history of septal surgery has predominantly been characterized by a slow progression toward conservatism. The earliest techniques used transmucosal reductions of deviations. As with all new surgical approaches, long-term complication rates and failures began to emerge. The resulting problems of septal perforation and nasal collapse prompted the development of the submucosal resection technique by Freer¹ and Killian,² which was less radical in nature, preserving a mucoperichondrial cover.^{1,2} This allowed for manipulation of the cartilaginous and bony septal framework without violating the integrity of the septal mucosa. Although this was a significant advance for intranasal surgery, limitations existed and long-term results were unsatisfactory in selected cases. In severely deviated and externally deviated noses, the submucosal resection was unable to address the most dorsal component of the quadrangular plate.

Poor functional results and persistent nasal obstruction resulted from mucosal atrophy, septal perforation, persistent dorsal cartilage deviation, internal valve obstruction, and flail septal mucosal flaps. Overly aggressive applications of the submucosal resection technique also led to untoward external consequences, including saddling, columellar retraction, alar retraction, and tip ptosis secondary to loss of tip support. Increasingly, the importance of the nasal septum in maintaining form and function was recognized. Preservation of an L-shaped strut emerged as an important concept in maintaining dorsal and caudal septal support, preventing saddling and loss of tip stability.

This concept led to the development of various septoplasty procedures intended to limit cartilage removal and preserve the structural integrity of the septum while addressing pathologic abnormality.^{3,4} These procedures included cartilage scoring techniques, compartmentalization with trimming, suture techniques, cartilage splinting using ethmoid bone or carti-

lage, swinging door techniques, and other maneuvers that are frequently used by contemporary rhinologic surgeons.⁵

The current state of septal surgery is an amalgam of septoplasty and judicious submucosal resection. However, even with a large armamentarium, limitations still exist. Many of these techniques cannot fully correct both internal and external deviations. External correction with onlay camouflage grafting is often used in these situations. In severe deviations, long-term failures continue to emerge owing to cartilage memory, graft failure, and scar formation. Because of this, a shift away from conservatism has recently occurred in the form of extracorporeal septoplasty. This technique is effective in restructuring and straightening the osseocartilaginous plate but includes the added risks associated with free grafts: resorption, extrusion, and displacement.⁶

The dissatisfaction of the senior author (W.L.) with the results of these available techniques led to a search for other methods. The theory of interlocking stresses dictates that an intrinsic balance of tensile and compressive forces exists within the cartilage, which can be exploited for cartilage-reshaping pro-

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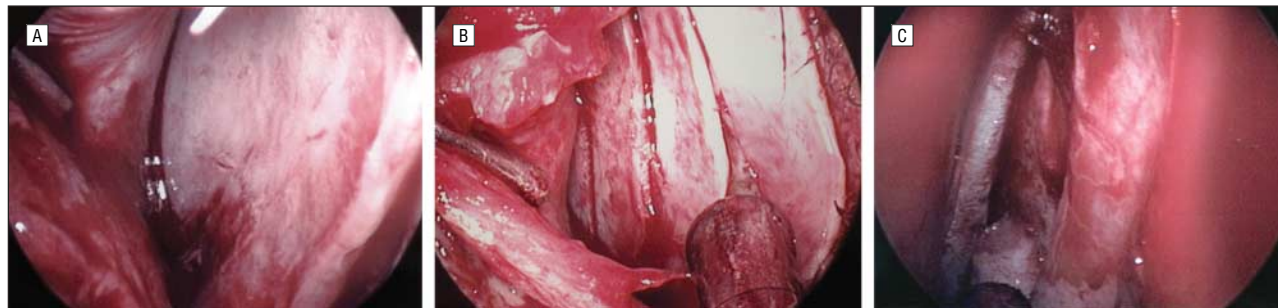


Figure 1. Intraoperative view of the technique. A, Mucosal leaf elevated on concave side of septal deviation from maxillary crest to nasal dorsum. B, Full-thickness vertical incisions on the concave side extending through the dorsal septum. C, Removal of cartilaginous compartment to compensate for lengthening and prevent postoperative telescoping of columns.

cedures. Fry⁷ demonstrated that partial cartilaginous incisions could increase bowing on the convex surface and straighten concave deviations. However, the degree of distortion depended on the cartilage thickness and cellular architecture, making results unpredictable. Later, Murakami et al⁸ showed that full-thickness incisions that preserved only the contralateral mucoperichondrium resulted in reliable correction of deformed pig ear cartilage. Applying these principles and his experience with swinging-door techniques for caudal septal correction, the senior author (W.L.) developed the fan septoplasty for correcting the severely deviated cartilaginous vault during endonasal rhinoplasty. This, in conjunction with various osteotomy techniques, has provided the senior author (W.L.) with excellent long-term results in most patients treated in this manner.

TECHNIQUE

The patient is prepared for surgery and administered an injection of 1% lidocaine with epinephrine (1:100 000) in a standard fashion. An endonasal rhinoplasty approach is used: full transfixion incision, intercartilaginous incision, and dorsal skeletonization of the nose. With the exception of osteotomies, all components of the rhinoplasty operation are performed before septal correction. Separation of the upper lateral cartilages from the septum is then done bilaterally, because tethering in the severely deviated nose may result in persistence of deformity. If concern for nasal valve collapse exists (such as patients with short nasal bones and long upper lateral cartilages), separation can be done submucosally. However, in severe cases, we do not recommend this approach, because less movement of the upper lateral cartilage in relation to the septum is achieved. Mucoperichondrial elevation is performed on the concave side of the septum from the floor of the nose up to and through the nasal dorsum. Care must be taken when replacing the septal flap during closure of the transfixion incision, because it is completely freed dorsally. Separation of the osseocartilaginous junction allows bilateral elevation over the bony septum, which is partially removed if pyramid deviation exists.

Using a number 15-blade scalpel, full-thickness parallel vertical incisions that preserve the opposite mucoperichondrium are made (**Figure 1B**). The number of incisions is determined by the degree and character of the deviated areas. In general, for ease of handling and modification, strips should be 5 to 10 mm wide. Despite the aggressive sectioning of the cartilage, no danger of dorsal sad-

dling exists as long as the attachment to the maxillary crest is maintained. The exception to this rule is on the most caudal strut, which may be detached from the floor, trimmed, and then fixed to the anterior nasal spine using a permanent or absorbable suture. Additional support for all cartilage elements is gained by preservation of their attachments to the intact opposite mucoperichondrium.

The result is the creation of coplanar columns of septal cartilage that can be transposed to a midline position. With the release of the tensile forces, parallel columns of cartilage fan out and increase in length both craniocaudally and anteroposteriorly. A column or portion (depending on width) of cartilage must be removed to prevent telescoping and overlapping of segments (**Figure 1C**). This cartilage can then be used as an onlay or spreader graft on the concave side, where deficiency of the upper lateral cartilage universally exists. Dorsal trimming is necessary if increased nasal height is not desired.

With the cartilaginous columns transposed to midline, the septal flaps are reapproximated. Before this, figure-8 sutures can be placed submucosally to oppose adjacent columns, but we have not found this maneuver necessary. Alternatively, this can be done transmucosally during placement of a septal quilting stitch. Either 1 or 2 septocolumellar sutures of 3-0 chromic gut are used to stabilize the most caudal segment in the midline. Knots are placed on the concave side to facilitate further straightening of the caudal cartilage.

Osteotomies are then performed according to the surgeon's preference. For the deviated pyramid, we recommend a combination of bilateral medial and lateral osteotomies with a perforating double lateral osteotomy on the side away from the deviation. This results in equalization of bony segments that will form the sidewalls of the reformed pyriform aperture.⁹

It is important to pack the nose with Vaseline gauze to help splint the reconfigured septal cartilage. Additionally, the packing provides support to the upper lateral cartilages, especially if onlay grafting has been done. Taping and casting of the external nose are performed in a routine fashion.

COMMENT

Nasal septal deformities often cause both functional and cosmetic problems. In general, deformity of the dorsal septal segment results in obstruction and airflow disturbance from coexisting midseptal deformities and curvilinear de-

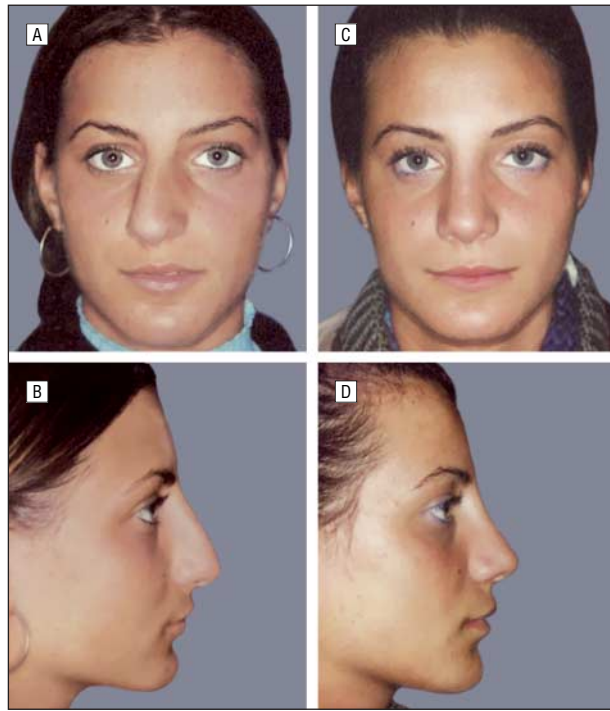


Figure 2. Deviation of the nose off the midline to the side of facial skeletal hypoplasia. Marked curvilinear deviation of the dorsal and caudal septum is present. A and B, Preoperative frontal and lateral views, respectively. C and D, One-year postoperative frontal and lateral views after fan septoplasty, modified Goldman septoplasty, double dome-binding suture, medial osteotomies, lateral osteotomies, and left perforating double lateral osteotomy, respectively.

viations of the cartilaginous vault with internal nasal valve obstruction on the convex side. A coexisting caudal deflection may cause external nasal valve obstruction and deformities of the nasal tip with medial crural flare. As mentioned previously, a variety of methods have been devised to correct internal and external septal abnormalities. However, many of these cannot simultaneously achieve both functional and aesthetic correction. The fan septoplasty permits simultaneous correction of intranasal, caudal, and external dorsal cartilaginous deviation.

The work of Cottle¹⁰ popularized the incisional cartilage preservation techniques, which eliminated many of the problems associated with aggressive submucous resection. Excellent surgical results were achieved in most cases, but residual deformities were still common in patients with severely deformed noses. The concept of segmentalizing a deviated cartilage to straighten it also gained applicability in the correction of caudal septal deviations.

The swinging door method of caudal septal corrections was devised and popularized by Goldman.⁵ This method allowed for caudal correction without compromising the support of the tip-columellar complex, representing a significant improvement in the management of caudal septal deformities. Interestingly, it violated the L-strut principle and demonstrated that full vertical incisions of the quadrangular plate could be safely done without causing saddle deformities. As described in other publications,¹¹ the senior author (W.L.) modified Goldman's approach by leaving 1 mucosal flap attached to the caudal segment. This helped to maintain its vascularity and gave additional support during the healing phase.

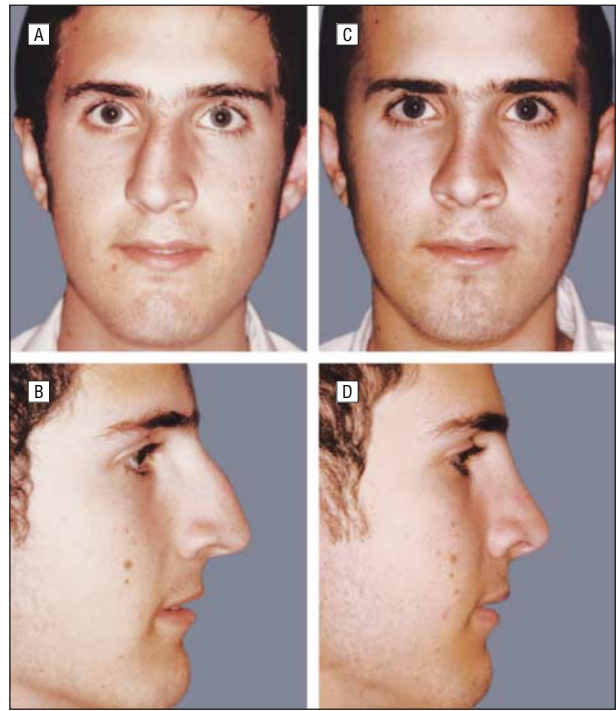


Figure 3. Marked midseptal curvilinear deviation involving the bony and cartilaginous dorsum. A and B, Preoperative frontal and lateral views, respectively. C and D, One-year postoperative frontal and lateral views after fan septoplasty, medial osteotomies, lateral osteotomies, and medial crura binding suture, respectively.

The fan septoplasty is an extension of this swinging door technique. Many of the same principles apply: maintaining vascularity and support for the individual columns by elevating a unilateral mucosal flap, and trimming of excessive cartilage. Current knowledge of cartilage biomechanics dictates that full-thickness incisions of the septal cartilage, maintaining an intact opposite perichondrial leaf, are necessary to fully and consistently release the tensile forces within the deviated segments. The fan septoplasty represents the clinical application of this principle. Although this technique may be considered radical in nature, it is used only for the most severely deviated noses and represents an endonasal alternative to extracorporeal septoplasty.

The fan septoplasty lends itself to concomitant rhinoplasty, which is often necessary in the setting of severe septal conditions. Noses classified as having C-shaped, double reverse-C, and S-shaped deformities can be corrected using this approach. Because incisions are carried through the nasal dorsum, the area of the quadrangular plate adjacent to the internal nasal valve is simultaneously straightened. Caudal deflections are repaired using the swinging door principle. This approach often precludes the need for spreader grafting, septal stenting, tongue in groove, extracorporeal septoplasty, caudal extension grafting, suture modification, and other techniques used in open rhinoplasty (**Figure 2**). Dissection of the tip cartilages can therefore be avoided or minimized if further modification is not aesthetically required (**Figure 3**).

If clinically significant warping of the midseptum persists (eg, if a double reverse-C deformity existed preoperatively), a staged correction is planned; submucous re-

section can later be safely performed using the unelevated concave mucosal flap for access. If needed, further dorsal refinement and camouflage grafting can be performed at that time.

The cartilaginous vault is effectively reconfigured rather than restructured with this approach. Simultaneous correction of functional and aesthetic concerns is achieved with a single maneuver. This approach helps to decrease operative time and give additional predictability during postoperative healing by minimizing graft use. Although dorsal irregularities are possible given the number of independent columns created, we have not experienced significant problems in this regard. Prophylactic onlay grafting of crushed cartilage or fascia may be considered in patients with thin skin. Complications using the fan septoplasty are not increased compared with what is commonly seen using other maneuvers. In general, we have found this technique extremely useful in severely deviated noses and recommend it as an endonasal alternative to other common modalities.

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